



The Adapting to Rising Tides Project

www.adaptingtorisingtides.org



San Francisco Bay Conservation
and Development Commission

Adapting to Rising Tides

Working together to increase the resilience of Bay Area communities to sea level rise and storm events



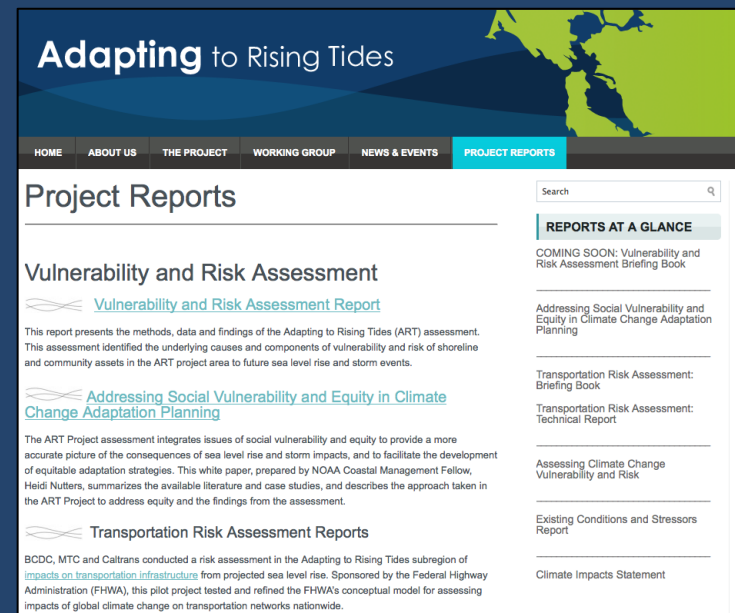
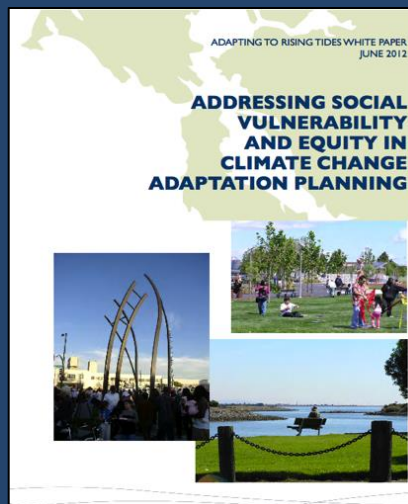
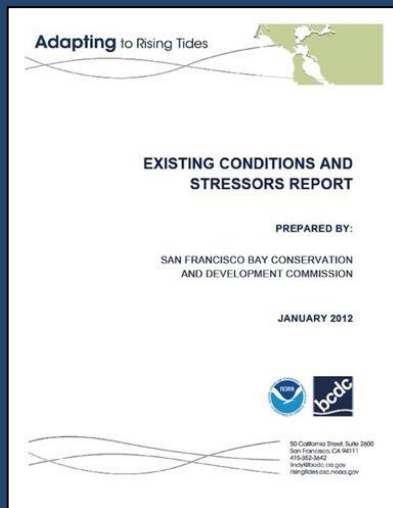
ART Project Outcomes

- Road tested adaptation tools, data, and resources that benefit project participants and others in the region and beyond
- An understanding of how scale affects the outcomes of adaptation planning
- Integration of all aspects of sustainability into the planning process and outcomes



ART Project Materials

- ✓ Existing Conditions and Stressors Report
- ✓ Approaches to Assessing Climate Change V&R
- ✓ Vulnerability & Risk Assessment
- ✓ Synthesizing Vulnerability & Risk: The Define Step
- ✓ Developing an Adaptation Response: The Plan Report
- ✓ Equity Issue Paper
- ✓ Governance Issue Paper



ART Project Key Findings



Networked infrastructure is only as resilient as the weakest link



Data and information gaps were significant for every sector analyzed



Certain land uses are difficult to protect, evacuate, relocate or rebuild



Certain characteristics make community members more vulnerable



Emergency preparedness, response and recovery has an uneven record of addressing the needs of all community members

ART Project Conclusions

- There are a number of actions the region can take *now* to help improve resilience to climate and other disruptions- economic, seismic, system failures
- Local agencies, organizations and communities need support convening climate adaptation efforts
- ART-tested tools, data, and resources are facilitation adaptation planning around the region and are paving the way towards implementation



ART Next Steps: Project to Program

Adapting to Rising Tides

HOME ABOUT US THE PROJECT WORKING GROUP NEWS & EVENTS PROJECT REPORTS

Now Available: ART Subregional Adaptation Responses
Photo credit: David Corby

Welcome!

Adapting to Rising Tides — the ART Project — is a collaborative planning effort to help San Francisco Bay Area communities adapt to sea level rise and storm event flooding. Led by the San Francisco Bay Conservation and Development Commission and the National Oceanic and Atmospheric Administration Coastal Services Center, the ART Project has engaged local, regional, state and federal agencies and organizations, as well as non-profit and private associations. Together, the ART Project team and its partners are working towards the project goal of increasing the Bay Area's preparedness and resilience to sea level rise and storm events while protecting critical ecosystem and community services.

Watch the video to learn more about the ART Project.

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

San Francisco Bay
Conservation and Development Commission



ADAPTING TO RISING TIDES WHITE PAPER
JUNE 2012

ADDRESSING SOCIAL VULNERABILITY AND EQUITY IN CLIMATE CHANGE ADAPTATION PLANNING

Structural shorelines protect the built and natural environment, including key infrastructure, parks and natural areas, and the people that live and work along the Bay. In the ART project area, three categories of structural shorelines were identified: (1) engineered flood protection, e.g., levees/dike/bulkheads, designed to protect inland areas from a 100-year water level; (2) engineered shoreline protection, e.g., relocations of bulkheads that narrow the edge to reduce erosion; and (3) non-engineered berms, e.g., mounds of Bay mud placed to increase managed bylaws from the Bay, which can also provide "soft" flood protection.

The shoreline of the northern portion of the ART project area, e.g., Emeryville, Oakland, and Alameda, is urbanized, and engineered flood and shoreline protection predominates. The southern portion of the ART project area, e.g., Hayward, has a less developed shoreline edge, and structures mostly consist of non-engineered berms. Structural shoreline assets are owned, maintained, regulated, and financed by a complex system of local, regional, state, and federal agencies, including Alameda County Flood Control and Water Conservation District, California Department of Transportation (e.g., around the San Francisco-Oakland Bay Bridge), the U.S. Army Corps of Engineers (e.g., around navigable waters), East Bay Regional Parks District, Hayward Area Recreation and Park District (along the Hayward Regional Shoreline), and the California Department of Fish and Wildlife (along Eden Landing Ecological Reserve).

Key Issues

Structural shorelines are vulnerable to sea level rise and storm events that expose them to additional tidal currents, waves, energy, runoff and overtopping, which can weaken structures and increase their potential for failure. Different types of structural shorelines have differing sensitivities. Specifically, engineered flood protection is vulnerable to levee crest and backside erosion if overtopped, while engineered shoreline protection is vulnerable to modification of the armor layer and erosion of the foundation. Non-engineered berms are especially vulnerable to erosion waves and tidal action because they have not been engineered to meet specific design criteria and are often not maintained on a regular basis. The vulnerability of any particular stretch of structural shoreline in the ART project area depends on its location, type, design, and maintenance. Structures that have space to be expanded or improved, have dedicated funding and permit authorizations for maintenance and improvements, and are already included in long-range capital improvement planning are less vulnerable. Relocation of some structures to a new inland position may be necessary in some instances, and a multi-agency approach is required to assess the feasibility and potential effectiveness of these types of projects.

Vulnerabilities

Timing

- Most of the structural shorelines in the ART project area will be reached by mid-century during a 100-year storm event that is coupled with wind waves.
- By the end-of-century, more than one third of the shoreline will overlap at daily high tide, and most of the shoreline will overlap during 100-year storm events.

Physical and Functional Qualities

- Depending on the type and design, structural shorelines have varying sensitivity to tidal action, wave energy, and overtopping which can cause erosion, destabilization and failure. For example, non-engineered berms are highly vulnerable due to limitations in their design and maintenance.
- Engineered flood protection, such as levees, is sensitive to overtopping, which can decrease structural stability and increase the potential for failure.
- Engineered shorelines and structures, such as seawalls, are sensitive to erosion and overtopping because generally armoring to displace or prevent wave action, and sea level rise may increase wave heights and velocities.
- Structural shorelines are vulnerable if there are technical, physical or environmental constraints that limit the ability to increase their height, for example if located in an environmentally sensitive area (adding height requires an increase in footprint).

Consequences

Scale

- Asset itself
- Adjoining properties and neighborhoods
- Regional to international depending on the assets protected (e.g., the airport or seaport)

People

- If structural shorelines overlap or fail, the people protected by them, including socially vulnerable communities, will be subjected to flooding.

Economy

- If structural shorelines overlap or fail, infrastructure critical to the region's economy, such as the Bay Bridge, the seaport, or the Oakland International Airport are at risk of significant disruption, with significant economic consequences that reach beyond the region or even the state.
- Repairing, maintaining and improving structural shorelines require significant resources, and can have consequences on the local, subregional and regional economy.



Adapting to Rising Tides

Structural Shorelines Vulnerability and Risk Profile

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ADAPTING TO RISING TIDES ISSUE PAPER
MAY 2013

ADAPTING GOVERNANCE FOR RISING TIDES

Managing Uncertainty

- Longer Time Horizons
- Place-Specific Effects
- "Surprise" as Normal
- Climate Change in a Changing World

Coping with Complexity

- Synchronizing Adaptation Policies
- Coordinating Local, Regional, State & Federal Efforts
- Pilot Projects
- Bridging Institutional Divides

Confronting Resource Constraints

- Proactive Measures
- Incorporating Adaptation into Existing Plans & Practices
- Redistributing Costs Among Institutions & Organizations

Adapting to Rising Tides

Impacts Assessment

The Adapting to Rising Tides project is assessing how sea level rise and storm events will affect shoreline and community assets. This analysis begins with an Impacts Assessment (see figure). The impacts assessment includes two components, local climate projections and an asset inventory. Together, these components directly inform the next phase of the focus step, determining vulnerability and risk.

Local Climate Projections: Sea Level Rise and Storm Events

First, project staff selected local climate projections for sea level rise and storm events to use in the assessment. Then, with the help of the Adapting to Rising Tides Communications Subcommittee, staff prepared climate impact statements that broadly describe the potential effects associated with these projections. Together, the projections and the impact statements help to define the scope of the vulnerability and risk assessment.

Asset Inventory

The Adapting to Rising Tides Subregion Working Group and project staff identified twelve categories of community assets, such as infrastructure, land uses and resources to be assessed in the project area. The existing conditions and stresses of each asset category were evaluated and summarized in a project report.

The "ASSESS" Step of the Adaptation Planning Process

SCORE & INVENTORY ASSESS PLAN IMPLEMENT & MONITOR

Impacts

- Local Climate Projections
- Sea level rise and storm events
- Asset Inventory
- Local asset categories
- Choose metrics to characterize assets
- Use metrics to assess existing conditions and stresses of assets

Vulnerability

- Exposure
- Sensitivity
- Adaptive Capacity
- Inherent ability of an asset to accommodate or adjust to an impact or to perform functions

Risk

- Likelihood
- Consequence
- Magnitude of social, economic, and environmental effects if an impact does occur

ART Portfolio

- Easy to use web-based toolkit of ART-tested adaptation tools, data, and resources
- At-your-fingertips ART adaptation findings, reports, and communication materials



ART Help Desk

- ART staff ready and available to answer questions and keep the ART Portfolio up-to-date and relevant
- Experienced adaptation planning staff to lend a helping hand to efforts led by others
- Assistance in convening multi-sector and multi-jurisdiction climate adaptation efforts



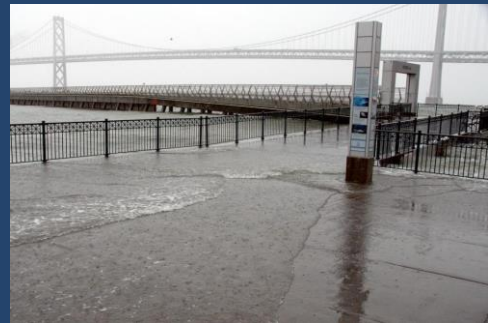
ART Focus on Regional Assets

- ✓ Shoreline Parks – developing a shoreline parks adaptation plan (BCDC and East Bay Regional Park District)
- ✓ Passenger Rail – supporting an ART partner-led assessment of sea level rise and storm event “hot spots” (BCDC and Capitol Corridor JPA)
- ✓ Ground Transportation – adaptation responses to reduce disruptions to transportation systems (BCDC, MTC, BART and Caltrans)



ART Focus on Regional Action

- ✓ Regional Housing and Community Risk Project – improving the odds of recovery by understanding and addressing housing and community risks (BCDC and AGAG)
- ✓ Resilient Shorelines Program – regional initiative to reduce flood risk hazards and increase shoreline resilience (BCDC, SCC and ABAG)



ART Focus on Local Action

- ✓ Oakland / Alameda Resilience Study – assessing shoreline flooding and seismic risk together to develop responses that will protect community and economic assets (BCDC and ABAG)
- ✓ Hayward Shoreline Resilience Study – developing a vision to protect local values and regionally significant networked infrastructure

